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FIRST OBSERVATION OF BOUND-STATE BETA DECAY . The beta decay of a nucleus in which the emitted electron becomes bound in the daughter atom was first predicted in 1947. Now scientists at the Institute of Heavy Ion Research (GSI) at Darmstadt, Germany have observed such a decay in completely ionized (+66) dysprosium atoms circulating in a storage ring. Although neutral Dy is stable, in a fully stripped form it decays via bound-state beta decay into highly ionized (+66) holmium (atomic number 67) with a halflife of 47 (+5,-4) days, a value derived from the measured storage time of the holmium daughter ions. The GSI scientists report that bound-state beta decay is of minor importance for neutral atoms but might be the predominant decay mode for highly ionized atoms, such as those inside stellar plasmas during nucleosynthesis. Studies of these decays (which are accompanied by a essentially monoenergetic antineutrino) may lead to more precise bounds on the mass of the antineutrino. (M. Jung et al., Phys. Rev. Lett., 12 Oct. 1992.)

1. EN.WIKIPEDIA.ORG

Lifted from (http://en.wikipedia.org/wiki/Beta_decay#Bound-state .CE.B2- decay)

For fully ionized atoms (bare nuclei), it is possible for electrons to be emitted from the nucleus into low-lying atomic bound states (orbitals). This can not occur for neutral atoms whose low-lying bound states are already filled. The phenomenon was first observed for 163Dy66+ in 1992 by Jung et al. of the Darmstadt Heavy-Ion Research group. Although neutral 163Dy is a stable isotope, the fully ionized 163Dy66+ undergoes β decay into the K and L shells with a half-life of 47 days.[1] Another possibility is that a fully ionized atom undergoes greatly accelerated β decay, as observed for 187Re by Bosch et al., also at Darmstadt. Neutral 187Re does undergo β decay with a half life of 42 x 10^9 years, but for fully ionized ${}_{187}\mathrm{Re}^{75+}$ this is shortened by a factor of 10^9 to only 32.9 years.[2] For comparison the variation of decay rates of other nuclear processes due to chemical environment is less than 1%.

$$(1) \qquad {}_{67}\mathrm{Ho}^{163} \longrightarrow {}_{66}\mathrm{Dy}^{163}$$

$$(2) \qquad \left({}_{66}\mathrm{Dy}^{163}\right)^{+66} \longrightarrow \left({}_{67}\mathrm{Ho}^{163}\right)^{+66} + \overline{\nu}$$

$$(3) \qquad {}_{75}\mathrm{Re}^{187} \longrightarrow {}_{76}\mathrm{Os}^{187} + \beta + \overline{\nu}\ ,\ 43 \times 10^9 \text{ years versus } \left({}_{75}\mathrm{Re}^{187}\right)^{+75} 32.9 \text{ years}$$

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